

What is claimed is:

1. A datagram relaying apparatus comprising:
a plurality of protocol terminating units;

and

a destination determining processor which
5 comprises:
a path selecting section which determines a
transfer destination route for a stream of packets
received from any of said protocol terminating units,
wherein said path selecting section determines whether
10 or not transfer of said received stream of packets to
said transfer destination route is in an inhibition
state, and selects another transfer destination route
when the transfer of the packet to said transfer
destination route is in the inhibition state.

2. A datagram relaying apparatus according to
claim 1, wherein said path selecting section
determines said transfer destination route or said
another transfer destination route based on a load
5 distribution ratio previously set for each said
transfer destination route.

3. A datagram relaying apparatus according to
claim 2, wherein said path selecting section manages
the stream count being currently allocated and the
maximum stream count to be allocated, for each said

09446460404

5 transfer destination route, and determines whether or
not the transfer of said received stream of packets to
said another transfer destination route is in the
inhibition state, based on the comparison between the
stream count being currently allocated and the maximum
10 stream count to be allocated.

7. A datagram relaying apparatus according to
claim 1, wherein said path selecting section manages
the stream count being currently allocated and the
maximum stream count to be allocated, for each said
5 transfer destination route, and determines that the
transfer of said received stream of packets to said
another transfer destination route is in the
inhibition state when the stream count being currently
allocated is equal to or greater than the maximum
10 stream count to be allocated.

8. A datagram relaying apparatus according to
claim 1, wherein said path selecting section monitors
whether or not a fault has occurred on said transfer
destination route, and assigns a stream of packets
5 allocated to said transfer destination route to said
another transfer destination route when said fault has
occurred on said transfer destination route.

9. A datagram relaying apparatus according to

TELETYPE UNIT

claim 8, wherein said path selecting section manages whether or not said fault has occurred, for every transfer destination route, and determines said
5 another transfer destination route based on said faults managed for the respective transfer destination routes.

10. A datagram relaying apparatus according to claim 9, wherein said path selecting section manages the transfer destination routes individually based on single data.

11. A datagram relaying apparatus according to claim 1, wherein said path selecting section determines said another transfer destination route based on a predetermined order.

12. A datagram relaying apparatus according to claim 1, wherein said path selecting section manages a maximum stream count to be continuously allocated, for each said transfer destination route, and continuously
5 determines said another transfer destination routes for said received stream of packets of packets to the maximum stream count to be continuously allocated, and then determines still another transfer destination route for another received stream of packets.

092441 040304
T03070 T0425760

13. A datagram relaying apparatus according to claim 1, wherein said path selecting section changes said transfer destination route each time said transfer destination route is determined.

14. A datagram relaying apparatus according to claim 1, wherein said path selecting section manages the stream count being currently allocated and the maximum stream count to be allocated, for each said transfer destination route, and after continuously allocating said another transfer destination routes until the stream count being currently allocated reaches the maximum stream count to be allocated, determines a still another transfer destination route.

15. A datagram relaying apparatus according to claim 1, wherein said path selecting section calculates an allocation rate of the stream count being currently allocated to a load distribution ratio for each said transfer destination route, and determines said transfer destination route having the smallest allocation rate as said another calculation result, when determining said another transfer destination route for said received stream of packets

10 packets.

16. A datagram relaying apparatus according to

claim 1, wherein said path selecting section manages the stream count being currently allocated and the maximum stream count to be allocated, for each said transfer destination route, and determines said transfer destination route having the smallest value when the stream count being currently allocated is divided by the maximum stream count to be allocated, as said another transfer destination route.

17. A datagram relaying apparatus according to claim 1, wherein said path selecting section discards a correspondence between said transfer destination route and said received stream of packets when a packet does not arrive for a predetermined time.

18. A datagram relaying apparatus comprising:
a plurality of protocol terminating units;
a destination address extracting section which extracts a destination address data to determine a transfer destination route from a header data of a packet received from any of said protocol terminating units;

a stream identifier calculating section which calculates a stream identifier to identify a stream from said header data of the packet received from any of said protocol terminating units;

a route determining section which determines

a multi-path identifier to uniquely identify a transfer path serving or a plurality of transfer destination routes as said transfer destination route, based on said destination address data;

a cache transfer path number memory which stores said stream identifier and said multi-path identifier in an address portion, and stores as a cache transfer path number, a transfer path number corresponding to said transfer path, based on a combination of said stream identifier and said multi-path identifier in a data portion;

a cache table accessing section which reads out said cache transfer path number corresponding to said combination of said stream identifier and said multi-path identifier from said cache transfer path number memory;

a transfer inhibition bit string memory which stores said multi-path identifier in an address portion, and stores in a data portion, a transfer inhibition bit string indicating whether or not transfer of the received stream of packets to said transfer path corresponding to said combination of the transfer path number and said multi-path identifier, for each said transfer path number, based on said multi-path identifier;

a transfer allocation path number memory which stores said multi-path identifier in an address

2025 RELEASE UNDER E.O. 14176

said path selecting section defines said
cache transfer path number as said transfer path
70 number, and reads out said transfer inhibition bit
string based on said multi-path identifier, and
determines whether or not the transfer of the packets
to said transfer path corresponding to the combination
of said transfer path number and said multi-path
75 identifier is in an inhibition state based on the read
out transfer inhibition bit string, and when the
transfer of the packets to said transfer path is in
the inhibition state, reads out said transfer
allocation path number based on said multi-path
80 identifier, and updates said transfer path number from
said cache transfer path number to said read out said
transfer allocation path number, and outputs said
transfer path corresponding to said combination of the
updated said transfer path number and said multi-path
85 identifier to said output device selecting section.

19. A datagram relaying apparatus according to claim 18, further comprising an allocation inhibition bit string memory which stores said multi-path identifier in an address portion, and stores in a data portion, an allocation inhibition bit string indicating whether or not allocation of said received stream of packets to said transfer path corresponding

to said combination of the transfer path number and
said multi-path identifier is in the inhibition state,
10 for each said transfer path number, based on said
multi-path identifier,

wherein said path selecting section reads out
said allocation inhibition bit string based on said
input said multi-path identifier, when updating said
15 transfer path number from said cache transfer path
number to said transfer allocation path number, and
specifies said transfer path number in which
allocation of said received stream of packets is not
in the inhibition state in the read out allocation
20 inhibition bit string, and then updates said transfer
allocation path number corresponding to said multi-
path identifier in said data portion of said transfer
allocation path number memory, based on the specified
transfer path number.

20. A datagram relaying apparatus according to
claim 18, further comprising:

an allocation stream count memory which
storing said multi-path identifier and said transfer
5 path number in an address portion, and storing in a
data portion an allocation stream count indicating the
stream count being currently allocated to said
transfer path number, based on said combination of
said multi-path identifier and said transfer path

09544040304

a maximum stream count memory when stores said multi-path identifier and said transfer path number in an address portion, and stores in a data portion, a maximum stream count indicating the maximum stream count to be allocated to said transfer path number, based on said combination of said multi-path identifier and said transfer path number,

wherein said path selecting section reads out said allocation stream count and said maximum stream count based on said combination of said transfer path number based on said input said cache transfer path number and said input said multi-path identifier, and compares the read out allocation stream count with said maximum stream count, and when said allocation stream count is greater than said maximum stream count, stores a fact that transfer of said received stream of packets to said transfer path corresponding to said combination of said multi-path identifier and said transfer path number is in an inhibition state in said transfer inhibition bit string, and when said allocation stream count is equal to or less than said maximum stream count, stores a fact that the transfer of the packet to said transfer path corresponding to said combination of said multi-path identifier and said transfer path number is in a permission state in said transfer inhibition bit string.

21. A datagram relaying apparatus according to claim 18, wherein said path selecting section stores a fact that the allocation of said received stream of packets to said transfer path corresponding to said combination of said multi-path identifier and said transfer path number is in the inhibition state in said allocation inhibition bit string when said allocation stream count is equal to or greater than said maximum stream count, and stores a fact that the allocation of the stream to said transfer path corresponding to said combination of said multi-path identifier and said transfer path number is at the permission state in said allocation inhibition bit string, when said allocation stream count is less than said maximum stream count.

22. A datagram relaying apparatus according to claim 20, wherein said path selecting section subtracts one from said allocation stream count corresponding to said combination of said multi-path identifier and said transfer path number corresponding to said cache transfer path number, when updating said transfer path number from said cache transfer path number to said transfer allocation path number, and further adds one to said allocation stream count corresponding to the combination of said multi-path identifier and said transfer path number after said

23. A datagram relaying apparatus according to claim 19, wherein said path selecting section defines a start value as a value next to a value of said transfer allocation path number in which said transfer path number is updated, and said path selecting section specifies said transfer path number in which the allocation of said received stream of packets is not in the inhibition state based on said allocation inhibition bit string, and then sequentially determines whether or not the allocation of said received stream of packets to said transfer path corresponding to a combination of said multi-path identifier and said transfer path number is in a permission state in said allocation inhibition bit string, and defines a value targeted for a next determination as a minimum value of said transfer path

23. A datagram relaying apparatus according to claim 19, wherein said path selecting section defines a start value as a value next to a value of said transfer allocation path number in which said transfer path number is updated, and said path selecting section specifies said transfer path number in which the allocation of said received stream of packets is not in the inhibition state based on said allocation inhibition bit string, and then sequentially determines whether or not the allocation of said received stream of packets to said transfer path corresponding to a combination of said multi-path identifier and said transfer path number is in a permission state in said allocation inhibition bit string, and defines a value targeted for a next determination as a minimum value of said transfer path

20

5

5

state based on said transfer allocation path number,
and divides the read out allocation stream count by
10 said maximum stream count to calculate an allocation
rate for each said transfer path number, and then
updates said transfer allocation path number stored in
said transfer allocation path number memory based on
said transfer path number having the smallest
15 allocation rate.

26. A datagram relaying apparatus according to
claim 19, further comprising:

a continuous allocation count memory which
stores said multi-path identifier in an address
5 portion, and stores in a data portion, a continuous
allocation count indicating the stream count
continuously allocated to said transfer path number
until this time, based on said multi-path identifier;
and

10 a maximum continuous allocation count memory
which stores said multi-path identifier and said
transfer path number in an address portion, and stores
a maximum continuous allocation count indicating the
maximum stream count continuously allocated to said
15 transfer path number in a data portion, based on said
combination of said multi-path identifier and said
transfer path number,

wherein said path selecting section adds one

097340304

to said continuous allocation count corresponding to
20 said multi-path identifier, after updating said
transfer path number based on said transfer allocation
path number read out from said transfer allocation
path number memory, and compares the added continuous
allocation count with said maximum continuous
25 allocation count, and specifies said transfer path
number in which the allocation of said received stream
of packets is not in the inhibition state in said
allocation inhibition bit string corresponding to said
multi-path identifier, when said continuous allocation
30 count is equal to or greater than said maximum
continuous allocation count, and then updates said
transfer allocation path number corresponding to said
multi-path identifier in said data portion of said
transfer allocation path number memory based on the
35 specified transfer path number.

27. A datagram relaying apparatus according to
claim 19, wherein said path selecting section updates
said transfer allocation path number corresponding to
said multi-path identifier in said data portion of
5 said transfer allocation path number memory, each time
said path selecting section updates said transfer path
number from said cache transfer path number based on
said transfer allocation path number read out from
said transfer allocation path number memory.

28. A datagram relaying apparatus according to claim 20, wherein said path selecting section updates said transfer allocation path number corresponding to said multi-path identifier in said data portion of
5 said transfer allocation path number memory, when said allocation stream count corresponding to said transfer allocation path number stored in said transfer allocation path number memory reaches said maximum stream count.

29. A datagram relaying apparatus according to claim 18, further comprising:

a channel identifier memory which stores a channel identifier corresponding to said transfer path
5 in a one-to-one correspondence relationship in an address portion, and stores said multi-path identifier and said transfer path number in a data portion, based on said channel identifier;

an operation mode memory which stores said
10 multi-path identifier in an address portion, and stores an operation mode indicating whether or not a fault has occurred on a physical link corresponding to said transfer path in a data portion, based on said multi-path identifier; and

15 a transfer path state bit string memory which stores said multi-path identifier in an address portion, and stores in a data portion, a transfer path

09752464-040304
T0009-104260

state bit string indicating whether or not the allocation of said received stream of packets and the transfer of said received stream of packets to said transfer path corresponding for each said transfer path number are in the inhibition state because of said fault occurrence, based on said multi-path identifier,

25 wherein said path selecting section specifies said channel identifier corresponding to said transfer path corresponding to said physical link having said fault from a fault occurrence report signal, when said fault occurrence report signal reporting said fault occurrence is received from said physical link, and specifies said transfer path number and said multi-path identifier corresponding to the specified channel identifier from said channel identifier memory, and updates said operation mode corresponding to the specified multi-path identifier to a fault occurrence state, and further stores the fact that the allocation of said received stream of packets and the transfer of said received stream of packets to said specified transfer path number are in the inhibition state in said transfer path state bit string corresponding to said specified multi-path identifier, reads out said operation mode corresponding based on said multi-path identifier received from said route determining section, when said stream is received from said

45 protocol terminating unit, reads out said transfer
path state bit string based on said multi-path
identifier, when the read out operation mode indicates
the fault occurrence state, and determines whether or
not the allocation and transfer of said received
50 stream of packets to said transfer path number are in
the inhibition state in the read out said transfer
path state bit string, and reads out said transfer
allocation path number based on said multi-path
identifier, when the allocation of said received
55 stream of packets and the transfer of the stream to
said transfer path number are in the inhibition state,
and updates said transfer path number to the read out
transfer allocation path number based on said cache
transfer path number, and outputs said transfer path
60 corresponding to said combination of the updated
transfer path number and said multi-path identifier to
said output device selecting section.

30. A datagram relaying apparatus according to
claim 29, wherein said path selecting section reads
out said transfer path state bit string based on said
multi-path identifier, when the read out operation
5 mode indicates the fault occurrence state based on
said input said multi-path identifier, and specifies
said transfer path number in which the allocation and
transfer of said received stream of packets are not in

the inhibition state in the read out transfer path
10 state bit string, and then updates said transfer
allocation path number corresponding to said multi-
path identifier in said data portion of said transfer
allocation path number memory based on the specified
said transfer path number.

31. A datagram relaying apparatus according to
claim 18, further comprising a usage path bit string
memory which stores said multi-path identifier in an
address portion, and stores a usage path bit string
5 indicating one ore more of said transfer paths
corresponding to the multi-path identifier in a data
portion, based on said multi-path identifier,
wherein said transfer path number corresponds
to each of said transfer paths different from each
10 other in a one-to-one relationship, and said transfer
path number is further constituted of the same data as
the corresponding transfer path,

said path selecting section stores said
transfer path state bit string indicating whether or
15 not the allocation and transfer of said received
stream of packets to each transfer path number and
each transfer path are in the inhibition state, and
specifies said transfer path corresponding to said
physical link having said fault from said fault
20 occurrence report signal when said fault occurrence

report signal reporting said fault occurrence is
received from said physical link, and stores a fact
that the allocation and transfer of said received
stream of packets to the specified transfer path are
25 in the inhibition state in said transfer path state
bit string, and reads out the corresponding usage path
bit string based on said multi-path identifier
received from said route determining section, when
said received stream of packets is received from said
30 protocol terminating units, and determines presence or
absence of said transfer path which is used in the
read out usage path bit string and in which the
allocation and transfer of said received stream of
packets are in the inhibition state in said transfer
35 path state bit string, and determines whether or not
the allocation and transfer of said received stream of
packets to said transfer path number corresponding to
said cache transfer path number received from said
cache table accessing section are in the inhibition
40 state based on said transfer path state bit string, in
the case of the presence of said transfer path which
is used in said usage path bit string and in which the
allocation and transfer of said received stream of
packets are in the inhibition state in said transfer
45 path state bit string, and reads out said transfer
allocation path number based on said multi-path
identifier, when the allocation and transfer of said

received stream of packets to said transfer path
number are in the inhibition state, and updates said
50 transfer path number based on the read out transfer
allocation path number based on said cache transfer
path number, and then outputs the updated transfer
path number to said output device selecting section,
and

55 said output device selecting section
transfers said received stream of packets based on
said transfer path number received from said path
selecting section.

32. A datagram relaying apparatus according to
claim 31, wherein said path selecting section
specifies said transfer path number in which the
allocation and transfer of said received stream of
5 packets are not in the inhibition state in said
transfer path state bit string, in the case of the
presence of said transfer path and said transfer path
number which are used in said usage path bit string
and in which the allocation and transfer of said
10 received stream of packets the packet are in the
inhibition state in said transfer path state bit
string, and updates said transfer allocation path
number corresponding to said multi-path identifier in
said data portion of said transfer allocation path
15 number memory based on the specified transfer path

0975461-010301
TOP SECRET

number.

33. A datagram relaying apparatus according to claim 18, wherein said cache transfer path number further has a bit different from a bit indicating the corresponding transfer path number,

5 the different bit stores therein a registration state bit indicating whether or not said cache transfer path number received from said cache table accessing section is at a non-registered state, and

10 said path selecting section determines whether or not said received cache transfer path number is in a non-registered state based on said different bit, and updates said transfer path number from said cache transfer path number to said transfer
15 allocation path number when said cache transfer path number is in the non-registered state.

34. A datagram relaying apparatus according to claim 18, wherein said path selecting section stores a predetermined bit pattern,

5 said cache transfer path number is composed of said predetermined bit pattern, when said transfer path number corresponding to said combination of said stream identifier and said multi-path identifier is in the non-registered state, and

10 said path selecting section determines
whether or not said cache transfer path number
received from said cache table accessing section is
composed of said predetermined bit pattern, and
determines whether or not said cache transfer path
number is in the non-registered state, and updates
15 said transfer path number from said cache transfer
path number to said transfer allocation path number
when said cache transfer path number is in the non-
registered state.

35. A datagram relaying apparatus according to
claim 18, wherein said path selecting section outputs
the specified transfer path number as an update path
number to said cache table accessing section, after
5 specifying said transfer path number to update said
transfer allocation path number stored in said
transfer allocation path number memory, and

 said cache table accessing section updates
said cache transfer path number corresponding to said
10 combination of said multi-path identifier and said
stream identifier in a data portion based on said
update path number, when said update path number is
received.

36. A datagram relaying apparatus according to
claim 18, wherein said transfer inhibition bit string

TESETE 040404

5 the corresponding multi-path identifier, and

10 to-one relationship, and a fact is stored indicating

5 divided by the corresponding said multi-path

10 number divided by said multi-path identifier in a one-

15 bit is in the inhibition state.

38. A datagram relaying apparatus according to claim 29, wherein said transfer path state bit string is composed of the number of bits equal to or greater than kinds of said transfer path numbers divided by
5 the corresponding said multi-path identifier, and
in each of the respective bits constituting said transfer path state bit string, each of the respective bits corresponds to said transfer path number divided by said multi-path identifier in a one-
10 to-one relationship, and a fact is stored indicating that the allocation and transfer of said received stream of packets to said transfer path corresponding to the corresponding transfer path number for each said bit are in the inhibition state.

39. A datagram relaying apparatus according to claim 31, wherein said transfer path state bit string is composed of the number of bits equal to or greater than kinds of said transfer path numbers, and
5 in each of the respective bits constituting said transfer path state bit string, each of the respective bits corresponds to said transfer path and said transfer path number in a one-to-one relationship, and a fact is stored indicating that an
10 allocation and transfer of said received stream of

TELETYPE

packets to said corresponding said transfer path and said transfer path number for each said bit are in the inhibition state.

40. A datagram relaying apparatus according to claim 33, further comprising an aging processing section which detects said combination of said transfer path number and said multi-path identifier
5 corresponding to said transfer path to which said received stream of packets is not transferred for a predetermined time, and sets said cache transfer path number stored in said data portion of said cache transfer path number memory corresponding to said
10 combination of said transfer path number and the detected said multi-path identifier, to the non-registered state.

41. A datagram relaying apparatus according to claim 40, wherein said path selecting section subtracts one from said allocation stream count corresponding to said detected combination of said
5 transfer path number and said multi-path identifier to which said received stream of packets is not transferred for said predetermined time, and updates said transfer inhibition bit string and said allocation inhibition bit string, based on the
10 subtracted allocation stream count and said maximum

FOUO FOUO FOUO

stream count.

42. A datagram relaying method comprising:
receiving a stream of packets; and
determining a transfer destination route for
said received stream of packets,

5 wherein said step of determining a transfer
path includes:

determining whether or not the transfer of
said received stream of packets to the determined
transfer destination route is in an inhibition state,
10 when said transfer destination route for said received
stream of packets; and

determining another transfer destination
route, when the transfer of said received stream of
packets to said transfer destination route is in the
15 inhibition state.

43. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

determining said transfer destination route
5 or said another transfer destination route based on a
load distribution ratio preliminarily set for each
said transfer destination route.

44. A datagram relaying method according to claim

2025 RELEASE UNDER E.O. 14176

42, wherein said step of determining a transfer path includes:

5 determining whether or not the transfer of
said received stream of packets to said transfer
destination route is in the inhibition state, based on
a comparison between the stream count being currently
allocated and the maximum stream count to be
allocated, which are managed for each said transfer
10 destination route.

45. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

5 determining that the transfer of said
received stream of packets to said transfer
destination route is in the inhibition state, when the
stream count being currently allocated is greater than
the maximum stream count to be allocated.

46. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

5 determining whether or not allocation of said
received stream to said another transfer destination
route is in the inhibition state.

47. A datagram relaying method according to claim

2025 RELEASE UNDER E.O. 14176

42, wherein said step of determining a transfer path includes:

5 determining whether or not the allocation of said received stream of packets to said another transfer destination route is in the inhibition state, based on the comparison between the stream count being currently allocated and the maximum stream count to be allocated, which are managed for each said transfer
10 destination route, when said another transfer destination route is determined for said received stream of packets.

48. A datagram relaying method according to claim 42, wherein said step of determining a transfer path includes:

5 determining that the allocation of said received stream of packets to said another transfer destination route is in the inhibition state, when the stream count being currently allocated which is managed for each said transfer destination route is equal to or greater than the maximum stream count to
10 be allocated which is managed for each said transfer destination route.

49. A datagram relaying method according to claim 42, wherein said step of determining a transfer path includes:

allocating said received stream allocated to
5 said transfer destination route having a fault to said
another transfer destination route, when said fault
has occurred on said transfer destination route.

50. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

determining said another transfer destination
5 route based on said fault occurrence managed for each
said transfer destination route, when said another
transfer destination route is determined.

51. A datagram relaying method according to claim
42, wherein said transfer destination route is managed
individually based on each single data.

52. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

determining said another transfer destination
5 route based on a preset predetermined order.

53. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

continuously determining said another

20250709 19:25:59

5 transfer destination route for said received stream of
packets until arrival of the maximum stream count to
be continuously allocated, which is managed for each
said transfer destination route; and

then, determining still another transfer
10 destination route for said received stream.

54. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

changing said transfer destination route
5 every time, when said another transfer destination
route is determined for said received stream of
packets.

55. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

continuously determining said still another
5 transfer destination routes, until the stream count
being currently allocated which is managed for each
said transfer destination route reaches the maximum
stream count to be allocated which is managed for each
said transfer destination route.

56. A datagram relaying method according to claim
42, wherein said step of determining a transfer path

2025 RELEASE UNDER E.O. 14176

includes:

calculating an allocation rate of the stream
5 count being currently allocated to said load
distribution ratio for each said preset said transfer
destination route, when said another transfer
destination route is determined for said received
stream of packets; and

10 determining said transfer destination route
having the smallest allocation rate as said another
transfer destination route.

57. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

determining as said another transfer
5 destination route, said transfer destination route
having the smallest value when the stream count being
currently allocated which is managed for each said
transfer destination route is divided by the maximum
stream count to be allocated which is managed for each
10 transfer destination route, when said another transfer
destination route is determined for said received
stream of packets.

58. A datagram relaying method according to claim
42, wherein said step of determining a transfer path
includes:

2025 RELEASE UNDER E.O. 14176

discarding a correspondence between said
5 received stream of packets and said transfer
destination route for said stream in which a packet
does not arrive for a predetermined time.

59. A datagram relaying method comprising:

extracting a destination address data from
header data of each of received packets of a stream to
determine a transfer destination route;

5 calculating a stream identifier to identify
said stream from said header data of said packet;

determining a multi-path identifier to
uniquely identify a transfer path serving as said
transfer destination route, or a plurality of transfer
10 destination routes, based on said destination address
data;

reading out said cache transfer path number
from a cache transfer number memory for storing said
stream identifier and said multi-path identifier in an
15 address portion based on a combination of said stream
identifier and said multi-path identifier and storing
as a cache transfer path number, a transfer path
number corresponding to said transfer path in a data
portion based on said combination of said stream
20 identifier and said multi-path identifier;

determining a transfer path serving as said
transfer destination route, based on said multi-path

09/5461-010304
TOP SECRET

identifier and said cache transfer path number, by
using a transfer path memory for storing said multi-
25 path identifier and said transfer path number in an
address portion, and for storing said transfer path in
a data portion based on said combination of said
multi-path identifier and said transfer path number;
and

30 transferring said received stream of packets
to said transfer path,

wherein said step of determining a transfer
path includes:

defining said cache transfer path number as
35 said transfer path number;

reading out a transfer inhibition bit string,
based on said multi-path identifier, from a transfer
inhibition bit string memory for storing said multi-
path identifier in an address portion and storing in a
40 data portion, said transfer inhibition bit string
indicating whether or not transfer of said received
stream of packets to said transfer path corresponding
to said combination of said multi-path identifier and
the transfer path number is in an inhibition state,
45 for each said transfer path number, based on said
multi-path identifier;

judging whether or not the transfer of said
received stream of packets to said transfer path
corresponding to said combination of said multi-path

SECRET
TOP SECRET

50 identifier and said transfer path number is in the
inhibition state based on the read out transfer
inhibition bit string;

when the transfer of said received stream of
packets to said transfer path is in the inhibition
55 state, reading out a transfer allocation path number,
based on said multi-path identifier, from a transfer
allocation path number memory for storing said multi-
path identifier in an address portion, and storing as
said transfer allocation path number, said transfer
60 path number corresponding to said transfer path in a
data portion, based on said multi-path identifier; and
updating said transfer path number from said
cache transfer path number to said read out said
transfer allocation path number.

60. A datagram relaying method according to claim
59, wherein said step of determining a transfer path
includes:

when updating said transfer path number from
5 said cache transfer path number to said transfer
allocation path number, reading out an allocation
inhibition bit string, based on said multi-path
identifier, from an allocation inhibition bit string
memory for storing said multi-path identifier in an
10 address portion, storing in a data portion for each
said transfer path number, said allocation inhibition

SECRET 010304

25 number.

includes:

reading out an allocation stream count and a
5 maximum stream count, based on said combination of
said transfer path number corresponding to said cache
transfer path number and said multi-path identifier,
from an allocation stream count memory for storing
said multi-path identifier and said transfer path
10 number in an address portion and storing an allocation
stream count indicating the stream count being
currently allocated to said transfer path number

corresponding to said combination of said multi-path
identifier and said cache transfer path number in a
15 data portion, and a maximum stream count memory for
storing said multi-path identifier and said transfer
path number in an address portion, and storing a
maximum stream count indicating the maximum stream
count to be allocated to said transfer path number in
20 a data portion, based on said combination of said
multi-path identifier and said transfer path number;

comparing the read out said allocation stream
count with said maximum stream count,

when said allocation stream count is greater
25 than said maximum stream count, storing in said
transfer inhibition bit string, a fact that the
transfer of said received stream of packets to said
transfer path corresponding to said combination of
said multi-path identifier and said transfer path
30 number is in the inhibition state;

when said allocation stream count is equal to
or less than said maximum stream count as said
comparison result between said allocation stream count
and said maximum stream count, storing in said
35 transfer inhibition bit string, a fact that the
transfer of said received stream of packets to said
transfer path corresponding to said combination of
said multi-path identifier and said transfer path
number is in a permission state.

SECRET
REF ID: A54366

62. A datagram relaying method according to claims 59, wherein said step of determining a transfer path includes:

when said allocation stream count is equal to
5 or greater than said maximum stream count as said
comparison result between said allocation stream count
and said maximum stream count, storing in said
allocation inhibition bit string, a fact that the
allocation of said received stream of packets to said
10 transfer path corresponding to said combination of
said multi-path identifier and said transfer path
number is in the inhibition state; and

when said allocation stream count is less
than said maximum stream count as said comparison
15 result between said allocation stream count and said
maximum stream count, storing in said allocation
inhibition bit string, a fact that the allocation of
said received stream of packets to said transfer path
corresponding to said combination of said multi-path
20 identifier and said transfer path number is at the
permission state.

63. A datagram relaying method according to claim 61, wherein said step of determining a transfer path includes:

when updating said transfer path number from
5 said cache transfer path number to said transfer

035461-01001
TOP SECRET

```
10 transfer path number;
```

```
15         comparing said subtracted allocation stream
count and said added allocation stream count with said
maximum stream count;
```

updating said transfer inhibition bit string
and said allocation inhibition bit string based on the
20 comparison result; and

64. A datagram relaying method according to claim 60, wherein said step of determining a transfer path includes:

when specifying said transfer path number in
5 which the allocation of said received stream of
packets is not in the inhibition state based on said

allocation inhibition bit string, defining a start
value as a value next to a value of said transfer
allocation path number in which said transfer path
10 number is updated;

judging whether or not sequential allocation
of said received stream of packets to said transfer
path corresponding to said combination of said multi-
path identifier and said transfer path number is in a
15 permission state in said allocation inhibition bit
string;

when a value targeted for the determination
becomes a maximum value of said transfer path number
in the determination, defining a value targeted for a
20 next determination as a minimum value of said transfer
path number,

judging whether or not the sequential
allocation of said received stream of packets to said
transfer path corresponding to said combination of
25 said multi-path identifier and said transfer path
number is in the permission state in said allocation
inhibition bit string.

65. A datagram relaying method according to claim
64, wherein said step of determining a transfer path
includes:

when the value targeted for said
5 determination becomes the same value as said transfer

2025 RELEASE UNDER E.O. 14176

allocation path number in which said transfer path
number is updated, setting said transfer path number
to update said transfer allocation path number
corresponding to said multi-path identifier in said
10 transfer allocation path number memory as a transfer
path number corresponding to said start value.

66. A datagram relaying method according to claim
61, wherein said step of determining a transfer path
includes:

when specifying said transfer path number in
5 which the allocation of said received stream of
packets is not in the inhibition state based on said
transfer allocation path number, reading out said
allocation stream count and said maximum stream count
for each said transfer path number based on said
10 multi-path identifier;

dividing the read out allocation stream count
by said maximum stream count, to calculate an
allocation rate for each said transfer path number;
and

15 updating said transfer allocation path number
stored in said transfer allocation path number memory
based on said transfer path number having the smallest
allocation rate.

67. A datagram relaying method according to claim

0973461-010304

60, wherein said step of determining a transfer path includes:

after updating said transfer path number
5 based on said transfer allocation path number read out from said transfer allocation path number memory, adding one to the corresponding continuous allocation count, based on said multi-path identifier, by using a continuous allocation count memory for storing said
10 multi-path identifier in an address portion, and storing a continuous allocation count indicating the stream count continuously allocated to said transfer path number until this time in a data portion, based on said multi-path identifier;

15 comparing the added continuous allocation count with said maximum continuous allocation count read out from a maximum continuous allocation count memory for storing said multi-path identifier and said transfer path number in an address portion, based on
20 said multi-path identifier, and storing said maximum continuous allocation count indicating the maximum stream count continuously allocated to said transfer path number in a data portion, based on said combination of said multi-path identifier and said
25 transfer path number;

when said continuous allocation count is equal to or greater than said maximum continuous allocation count, specifying said transfer path number

2025 RELEASE UNDER E.O. 14176

in which the allocation of said received stream of
30 packets is not in the inhibition state in said
allocation inhibition bit string corresponding to said
multi-path; and

updating said transfer allocation path number
corresponding to said multi-path identifier in the
35 data portion of said transfer allocation path number
memory based on the specified said transfer path
number.

68. A datagram relaying method according to claim
60, wherein said step of determining a transfer path
includes:

each time said transfer path number is
5 updated from said cache transfer path number based on
said transfer allocation path number read out from
said transfer allocation path number memory, updating
said transfer allocation path number corresponding to
said multi-path identifier in the data portion of said
10 transfer allocation path number memory.

69. A datagram relaying method according to claim
61, wherein said step of determining a transfer path
includes:

when said allocation stream count
5 corresponding to said transfer allocation path number
stored in said transfer allocation path number memory

035454-040304
T05070 T9425450

reaches said maximum stream count, updating said transfer allocation path number corresponding to said multi-path identifier in the data portion of said transfer allocation path number memory.

70. A datagram relaying method according to claim 59, wherein said step of determining a transfer path includes:

when a fault occurrence report signal reporting said fault occurrence is received from a physical link, based on said channel identifier to identify said transfer path corresponding to said physical link having said fault from the fault occurrence report signal, specifying said transfer path number and said multi-path identifier, from a channel identifier memory for storing a channel identifier corresponding to said transfer path in a one-to-one relationship in an address portion, and storing said multi-path identifier and said transfer path number in a data portion, based on said channel identifier;

updating to a fault occurrence state based on the specified multi-path identifier, said operation mode stored in an operation mode memory for storing said multi-path identifier in an address portion, and storing an operation mode indicating whether or not a fault has occurred on said physical link corresponding

TOCOTD.TA2E.60

25 based on said specified said multi-path
identifier, storing a fact that the allocation and
transfer of said received stream of packets to said
specified transfer path number are in the inhibition
state in said transfer path state bit string in a
30 transfer path state bit string memory for storing said
multi-path identifier in an address portion, and
storing in a data portion, a transfer path state bit
string indicating whether or not the allocation and
transfer of said received stream of packets to said
35 transfer path corresponding for each said transfer
path number are in the inhibition state because of
said fault occurrence, based on said multi-path
identifier;

```

        when the read out operation mode indicates
        said fault occurrence state, reading out said transfer
45 path state bit string based on said multi-path
        identifier;

```

judging whether or not the allocation and transfer of said received stream of packets to said transfer path number are in the inhibition state in

50 the read out said transfer path state bit string;

when the allocation and transfer of said
received stream of packets to said transfer path
number are in the inhibition state, reading out said
transfer allocation path number based on said multi-
55 path identifier; and

updating said transfer path number to said
read out transfer allocation path number based on said
cache transfer path number.

71. A datagram relaying method according to claim
70, wherein said step of determining a transfer path
includes:

when said read out operation mode indicates a
5 fault occurrence state based on said multi-path
identifier, reading out said transfer path state bit
string based on said multi-path identifier;

specifying said transfer path number in which
the allocation and transfer of said received stream of
10 packets are not in the inhibition state in the read
out said transfer path state bit string; and

updating said transfer allocation path number
corresponding to said multi-path identifier in the
data portion of said transfer allocation path number
15 memory based the specified said transfer path number.

72. A datagram relaying method according to claim

2025 RELEASE UNDER E.O. 14176

30 judging a presence or absence of said
transfer path which is used in the read out said usage
path bit string and in which the allocation and
transfer of said received stream of packets are in the
inhibition state in said transfer path state bit

in the case of the presence of said transfer path which is used in said usage path bit string and in which the allocation and transfer of said received stream of packets are in the inhibition state in said transfer path state bit string, judging whether or not the allocation and transfer of said received stream of packets to said transfer path number corresponding to said cache transfer path number are in the inhibition state based on said transfer path state bit string;

50 updating said transfer path number based on
the read out transfer allocation path number based on
said cache transfer path number.

73. A datagram relaying method according to claim
72, wherein said step of determining a transfer path

transfer path number is in the non-registered state based on said different bit; and

15 when said cache transfer path number is in the non-registered state, updating said transfer path number from said cache transfer path number to said transfer allocation path number.

75. A datagram relaying method according to claim 59, wherein said cache transfer path number is composed of said predetermined bit pattern, when said transfer path number corresponding to said combination
5 of said stream identifier and said multi-path identifier is in the non-registered state, and

 said step of determining a transfer path includes:

 determining whether or not said cache
10 transfer path number defined as said transfer path number is composed of said predetermined bit pattern which is stored in advance;

 determining whether or not said cache transfer path number is in the non-registered state;
15 and

 when said cache transfer path number is in the non-registered state, updating said transfer path number from said cache transfer path number to said transfer allocation path number.

0975461.010301

76. A datagram relaying method according to claim 59, wherein said step of determining a transfer path includes:

after specifying said transfer path number to
5 update said transfer allocation path number stored in
said transfer allocation path number memory, based on
the specified said transfer path number, updating said
cache transfer path number corresponding to said
combination of said multi-path identifier and said
10 stream identifier in a data portion of said cache
transfer path number memory.

77. A datagram relaying method according to claim 59, wherein said transfer inhibition bit string is composed of the number of bits equal to or greater than kinds of said transfer path numbers divided by
5 the corresponding multi-path identifier, and

in each of the respective bits constituting
said transfer inhibition bit string, each of the
respective bits corresponds to said transfer path
number divided by said multi-path identifier in a one-
10 to-one relationship, and

said step of determining a transfer path includes:

storing a fact that the transfer of said
received steam of packets to said transfer path
15 corresponding to the corresponding transfer path

2025 RELEASE UNDER E.O. 14176

number for each said bit is in the inhibition state.

78. A datagram relaying method according to claim 60, wherein said allocation inhibition bit string is composed of the number of bits equal to or greater than kinds of said transfer path numbers divided by 5 the corresponding multi-path identifier, and

in each of the respective bits constituting said allocation inhibition bit string, each of the respective bits corresponds to said transfer path number divided by said multi-path identifier in a one- 10 to-one relationship, and

said step of determining a transfer path includes:

storing a fact that the allocation of said received stream of packets to said transfer path 15 corresponding to said corresponding transfer path number for each said bit is in the inhibition state.

79. A datagram relaying method according to claim 70, wherein said transfer path state bit string is composed of the number of bits equal to or greater than kinds of said transfer path numbers divided by 5 the corresponding multi-path identifier, and

in each of the respective bits constituting said transfer path state bit string, each of the respective bits corresponds to said transfer path

2025 RELEASE UNDER E.O. 14176

number divided by said multi-path identifier in a one-
10 to-one relationship, and

said step of determining a transfer path
includes:

storing a fact that the allocation and
transfer of said received stream of packets to said
15 transfer path corresponding to the corresponding
transfer path number for each said bit are in the
inhibition state.

80. A datagram relaying method according to claim
72, wherein said transfer path state bit string is
composed of the number of bits equal to or greater
than kinds of said transfer path numbers, and

5 in each of the respective bits constituting
said transfer path state bit string, each of the
respective bits corresponds to said transfer path and
said transfer path number in a one-to-one
relationship, and

10 said step of determining a transfer path
includes:

storing a fact that the allocation and
transfer of said received stream of packets to the
corresponding transfer path and said transfer path
15 number for each said bit are in the inhibition state.

81. A datagram relaying method according to claim

74, further comprising:

detecting said combination of said transfer path number and said multi-path identifier

5 corresponding to said transfer path to which said received stream of packets is not transferred for a predetermined time; and

setting said cache transfer path number stored in the data portion of said cache transfer path
10 number memory corresponding to said combination of said transfer path number and the detected multi-path identifier, to a non-registered state.

82. A datagram relaying method according to claim 81, wherein said step of determining a transfer path includes:

subtracting one from said allocation stream
5 count corresponding to said detected combination of said transfer path number and said multi-path identifier to which said received stream of packets is not transferred for said predetermined time; and

updating said transfer inhibition bit string
10 and said allocation inhibition bit string, based on the subtracted allocation stream count and said maximum stream count.

2025 RELEASE UNDER E.O. 14176